

Work, Energy and Power – 2021 AS

1. **June/2021/Paper_11/No.15**

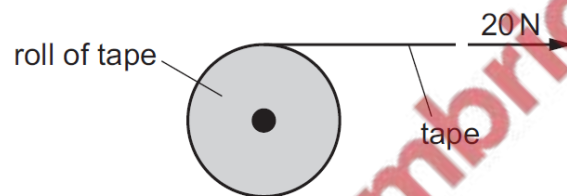
A rocket is fired upwards.

As it accelerates upwards after leaving the launch pad, which forms of energy are changing?

- A chemical energy, gravitational potential energy and kinetic energy
- B chemical energy and gravitational potential energy only
- C chemical energy and kinetic energy only
- D gravitational potential energy and kinetic energy only

2. **June/2021/Paper_11/No.16**

A roll of tape of length 50 m requires a constant force of 20 N to unwrap it.

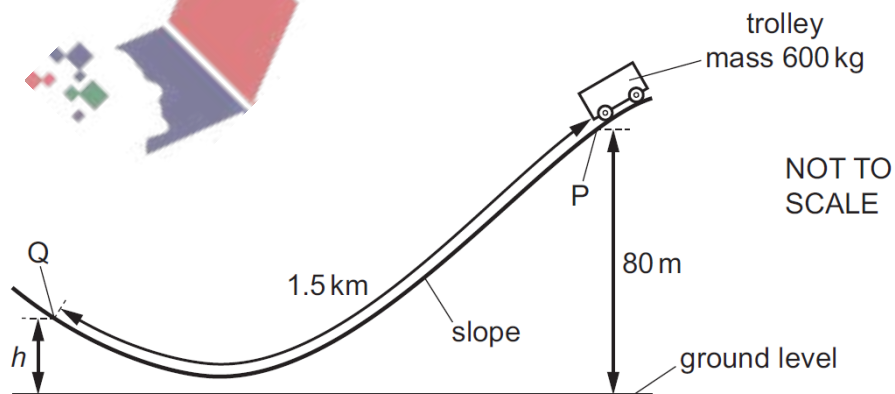


What is the work done in unwrapping the whole roll?

- A 0.4 J
- B 2.5 J
- C 500 J
- D 1000 J

3. **June/2021/Paper_11/No.17**

A trolley of mass 600 kg is initially at point P on a slope, at a height of 80 m above ground level, as shown. The trolley is released from rest and moves along the slope, first coming to rest at point Q, at height h above ground level.



The total distance PQ moved by the trolley along the slope is 1.5 km. A constant resistive force of 300 N opposes the motion of the trolley on the slope.

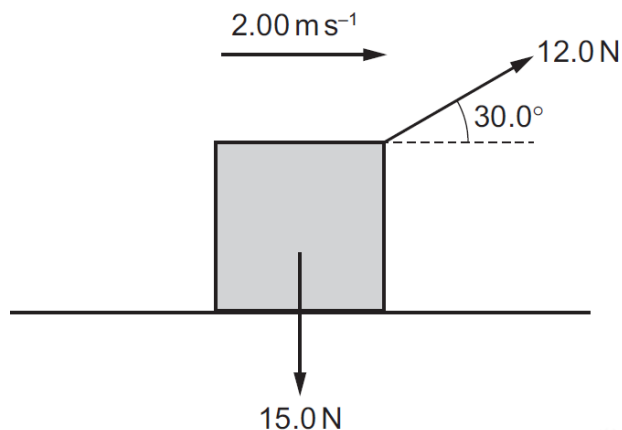
What is h ?

- A 3.5 m
- B 76 m
- C 79 m
- D 80 m

4. June/2021/Paper_11/No.18

An object of weight 15.0 N is pulled along a horizontal surface at a constant velocity of 2.00 m s^{-1} .

The force pulling the object is 12.0 N at 30.0° to the horizontal, as shown.



What is the power used to move the object?

- A 12.0 W B 20.8 W C 24.0 W D 30.0 W

5. June/2021/Paper_12/No.15

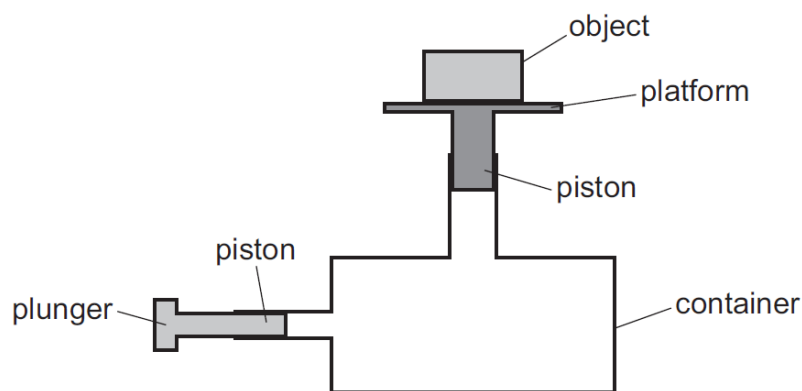
A stone is falling vertically through the air at a constant (terminal) velocity.

Which energy change is occurring?

- A gravitational potential energy to thermal energy
B gravitational potential energy to kinetic energy of the stone
C kinetic energy to gravitational potential energy of the stone
D kinetic energy of the stone to thermal energy

6. June/2021/Paper_12/No.16

An object of weight 12 N rests on a platform on top of a container with two pistons, as shown. The container contains a fixed mass of gas, and the pistons are free to move.



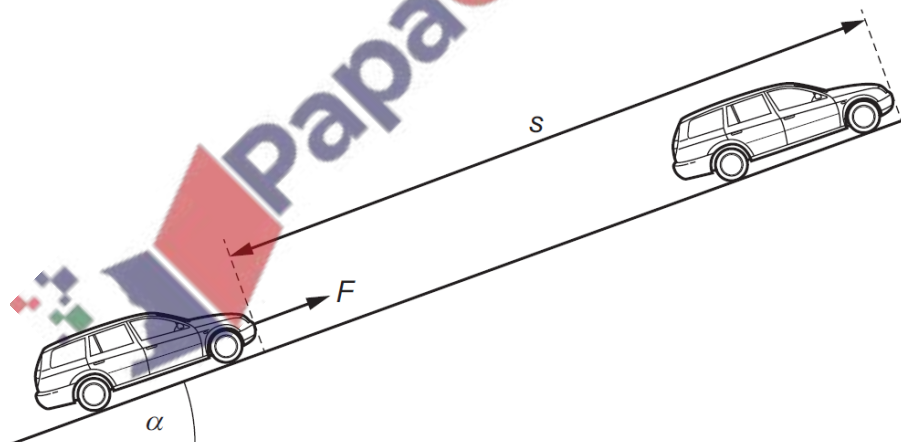
The plunger is slowly pushed 4.0 cm to the right. As a result, the object slowly moves upwards a distance 0.50 cm.

How much work is done on the object?

- A 0.060 J B 0.48 J C 6.0 J D 48 J

7. June/2021/Paper_12/No.17

A constant force F , acting on a car of mass m , moves the car up a slope through a distance s at constant velocity v . The angle of the slope to the horizontal is α .



The acceleration of free fall is g .

What is the ratio $\frac{\text{gravitational potential energy gained by car}}{\text{work done by force } F}$?

- A $\frac{mgs \sin \alpha}{Fv}$ B $\frac{mv}{Fs}$ C $\frac{mv^2}{2Fs}$ D $\frac{mg \sin \alpha}{F}$

8. June/2021/Paper_12/No.18

What is the definition of power?

- A Power is the product of force and velocity.
- B Power is the product of force and work done per unit time.
- C Power is the product of force per unit time and velocity.
- D Power is the rate at which work is done.

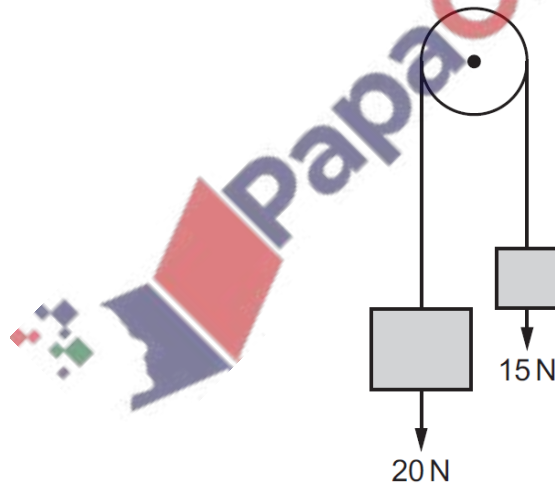
9. Nov/2021/Paper_11/No.15

Which statement about energy is **not** correct?

- A Energy is never lost but it may be transferred between different forms.
- B In an inelastic collision, the total energy is constant.
- C The efficiency of a system is the ratio of the useful energy output to the total energy input.
- D When a machine does work, friction reduces the total energy.

10. Nov/2021/Paper_11/No.16

A pulley of radius 0.40 m supports weights of 20 N and 15 N by means of a thin string, as shown.



The weights are moved by slowly rotating the pulley clockwise through an angle of 60° .

What is the increase in the total gravitational potential energy of the weights?

- A 0.33 J B 2.0 J C 2.1 J D 15 J

11. Nov/2021/Paper_11/No.17

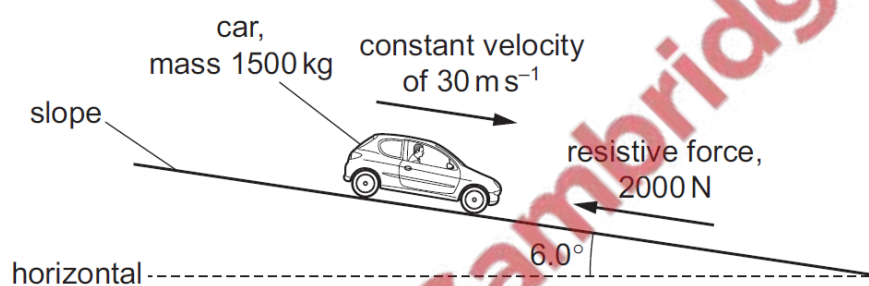
A car of mass 1500 kg accelerates from an initial speed of 15 m s^{-1} . This acceleration causes the car to gain $3.0 \times 10^5 \text{ J}$ of kinetic energy.

What is the change in the speed of the car?

- A 5.4 m s^{-1} B 10 m s^{-1} C 20 m s^{-1} D 25 m s^{-1}

12. Nov/2021/Paper_11/No.18

A car of mass 1500 kg travels at a constant velocity of 30 m s^{-1} down a slope. The slope is at an angle of 6.0° to the horizontal, as shown.



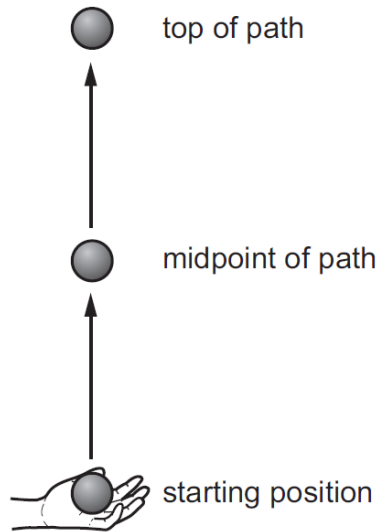
The magnitude of the total resistive force acting on the car is 2000 N.

What is the power output of the car's engine?

- A 14 kW B 60 kW C 110 kW D 380 kW

13. Nov/2021/Paper_12/No.16

A ball is thrown vertically upwards into the air. It rises to the top of its path before beginning to fall vertically downwards.



Assume that the gravitational potential energy of the ball is zero at its starting position.

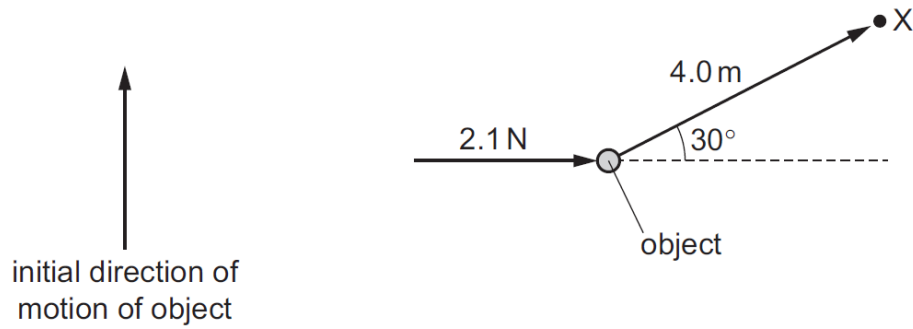
Which statement about the ball is **not** correct?

- A As it rises, its kinetic energy is transferred to gravitational potential energy.
- B At the midpoint of its path, its gravitational potential energy is equal to its initial kinetic energy.
- C At the top of its path, its kinetic energy is zero.
- D At the top of its path, its total energy is less than its initial total energy.

14. Nov/2021/Paper_12/No.17

An object slides with constant velocity across a horizontal sheet of ice. Friction is negligible.

A constant horizontal force of 2.1 N is then applied to the object as shown.



A short time after applying the force, the object reaches point X at a displacement of 4.0 m from its position when the force was first applied.

What is the work done by the force on the object as it travels to point X?

- A 4.2 J B 4.8 J C 7.3 J D 8.4 J

15. Nov/2021/Paper_12/No.18

The energy conversions inside a power station burning fossil fuel can be simplified as shown.

chemical energy $W \rightarrow$ thermal energy $X \rightarrow$ electrical energy Y

Which expression gives the efficiency of the power station?

- A $\frac{Y}{W}$ B $\frac{Y}{(W+X)}$ C $\frac{Y}{X}$ D $\frac{Y}{(W+X+Y)}$

16. Nov/2021/Paper_12/No.19

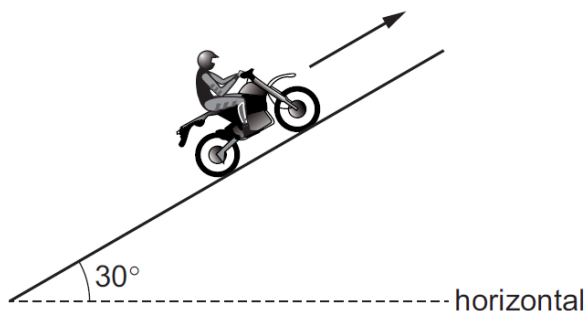
Car X is travelling at half the speed of car Y. Car X has twice the mass of car Y.

Which statement is correct?

- A Car X has half the kinetic energy of car Y.
B Car X has one quarter of the kinetic energy of car Y.
C Car X has twice the kinetic energy of car Y.
D The two cars have the same kinetic energy.

17. Nov/2021/Paper_12/No.20

The total weight of a motorbike and rider is 1800 N. The motorbike travels in a straight line at constant speed up a hill at an angle of 30° to the horizontal.



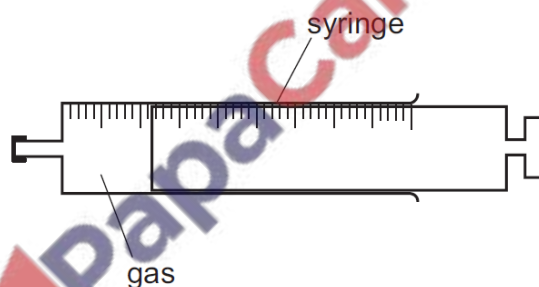
The useful output power of the motorbike is 36 000 W. The total resistive force due to air resistance and friction on the motorbike and rider is 2400 N.

What is the speed of the motorbike?

- A 8.6 ms^{-1} B 11 ms^{-1} C 15 ms^{-1} D 24 ms^{-1}

18. Nov/2021/Paper_13/No.16

A gas is contained inside a syringe, as shown.



The initial volume of the gas is 2.00 cm^3 .

Atmospheric pressure is 101 kPa.

What is the work done by the gas on the atmosphere when the gas is heated and expands to a volume of 6.00 cm^3 ?

- A $404 \mu\text{J}$ B 404 mJ C 404 J D 404 kJ

19. Nov/2021/Paper_13/No.17

A mechanical device does useful work at rate X and wastes energy at rate Y .

Which expression gives the efficiency of this device?

- A $\frac{X}{Y}$ B $\frac{(X-Y)}{Y}$ C $\frac{X}{(X+Y)}$ D $\frac{(X-Y)}{(X+Y)}$

20. Nov/2021/Paper_13/No.18

Car P has kinetic energy 240 kJ.

Car Q has half the mass and twice the speed of car P.

What is the kinetic energy of car Q?

- A 120 kJ B 240 kJ C 480 kJ D 960 kJ

21. Nov/2021/Paper_13/No.19

A water pump is driven by an engine. The pump raises a volume of 0.50 m^3 of water in 1.0 minute from a depth of 30 m. The pump has an efficiency of 70%.

The density of water is 1000 kg m^{-3} .

What is the useful output power from the engine?

- A 2.5 kW B 3.5 kW C 150 kW D 210 kW

